

VISIT...

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Blood



CBC (Complete blood count)

A – RBCs

B – Hematocrit

C – Hb

D – RBCs indices

E – WBCs + DLC

F – Platelet

Items outside CBC but may be helpful

- Reticulocytes (0.5-1.5%)
- Staff \ segment (1\5 – 1\10)
- Blood film
- BM aspiration
- RDW
- Bleeding time
- Coagulation profile

NORMAL VALUES:

A- RBCs

Male

4.5 - 6.5 million cells/mm³

Female

3.8 - 5.8 million cells/mm³

B- Hematocrit:- PCV (packed cell volume):-

Determines the percentage of red blood cells in the plasma

Male

40 – 50 %

Female

36 – 44 %

C- Haemoglobin:-

Male

13 – 18 gm/dl

Female

12 – 16 gm/dl

Hb % may be used

Colour index:-

$$\frac{\text{Hb\%}}{\text{RBCs \%}} = 1$$

> 1 = hyperchromic (wrong term)

< 1 = hypochromic.

Of no value in recent medicine

D- RBCs indices

MCV: 80 - 95 femtoliter
 MCH: 27 - 31 pg/cell
 MCHC: 32 - 36 gm/dl

1- Mean corpuscular volume (MCV):-

measures the mean or average size of individual red blood cells

= The hematocrit is divided by the total RBC count.

Hematocrit \ RBCs

Microcytic red blood cells

- iron deficiency anemia
- thalassemia.
- Sideroblastic anaemia
- Anaemia of chronic illness (some times)

Macrocytic red blood cells**DD of Macrocytosis****With megaloblasts**

↓ Vit B12

↓ Folic acid

Without megaloblasts

1. Reticulocytosis
2. Pregnancy
3. Alcoholism
4. Hypothyroidism
5. Liver cell failure
6. Chronic renal failure

Normochromic normocytic anemia

- Hemolytic anemia
- Aplastic anemia (↓ reticulocytes)
- Hypersplenism (↑ reticulocytes)

2- Mean corpuscular hemoglobin (MCH):-

measures the amount of hemoglobin present in one RBC.

= dividing the hemoglobin by the total RBCs

Hemoglobin \ RBCs

3- Mean corpuscular hemoglobin concentration (MCHC):-

measures the amount of hemoglobin present in each RBC proportionate to the RBC size.

Hemoglobin \ hematocrit X 100

The MCH and the MCHC are used to assess whether red blood cells are normochromic, hypochromic, or hyperchromic .

Anemias can be classified using erythrocyte indices in the following way:

1- MCV, MCH and MCHC normal

normocytic, normochromic anemia

2- Decreased MCV, MCH, and MCHC

microcytic, hypochromic anemia

3- Increased MCV, variable MCH and MCHC

macrocytic anemia

E- WBC: 4,000 - 11,000 cells/mm³

Granulocytes (or polymorphonuclears)

	Relative value	Absolute value
Neutrophils:	45 - 70%	3000-7000
Eosinophils:	2 - 4%	50 - 400
Basophils:	0 - 2%	0 - 100

Agranulocytes (or mononuclears)

	Relative value	Absolute value
Lymphocytes:	25 - 40%	1700 - 3400
Monocytes:	4 - 8%	400 - 800

The lifespan of white blood cells ranges from 13 to 20 days

F- Platelets: 120.000 - 450.000 / mm³

Red cell distribution width (RDW):- (Adults:- 11.7%-14.2%)

A calculation of the variation in the size of RBCs. In some anemias, such as megaloblastic anemia, the amount of variation (anisocytosis) in RBC size (along with variation in shape - poikilocytosis) causes an increase in the RDW.

Scheme of diagnosis

1st step

RBCs (Hb)

Increased

RBCs only

2ry polycythemia

All element:-
RBCs. WBCs & platelets

1ry polycythemia

Decreased

All element:-
RBCs. WBCs & platelets

Pancytopenia

Reticulocytes

Increased
Hypersplenism

Decreased

Megaloblastic
MCV or CI : increased
Anisocytosis & poikilocytosisAplastic anemia By :
BM aspiration

Anaemia

RBCs only

Alone سادة

RBCs indices

Increased WBCs

Leukaemia

blast cells

increased

Acute L

Decreased

Chronic L

Decreased Platelets

Thrombocytopenia
(prolonged BT)

Normocytic normochromic

Increased reticulocytes

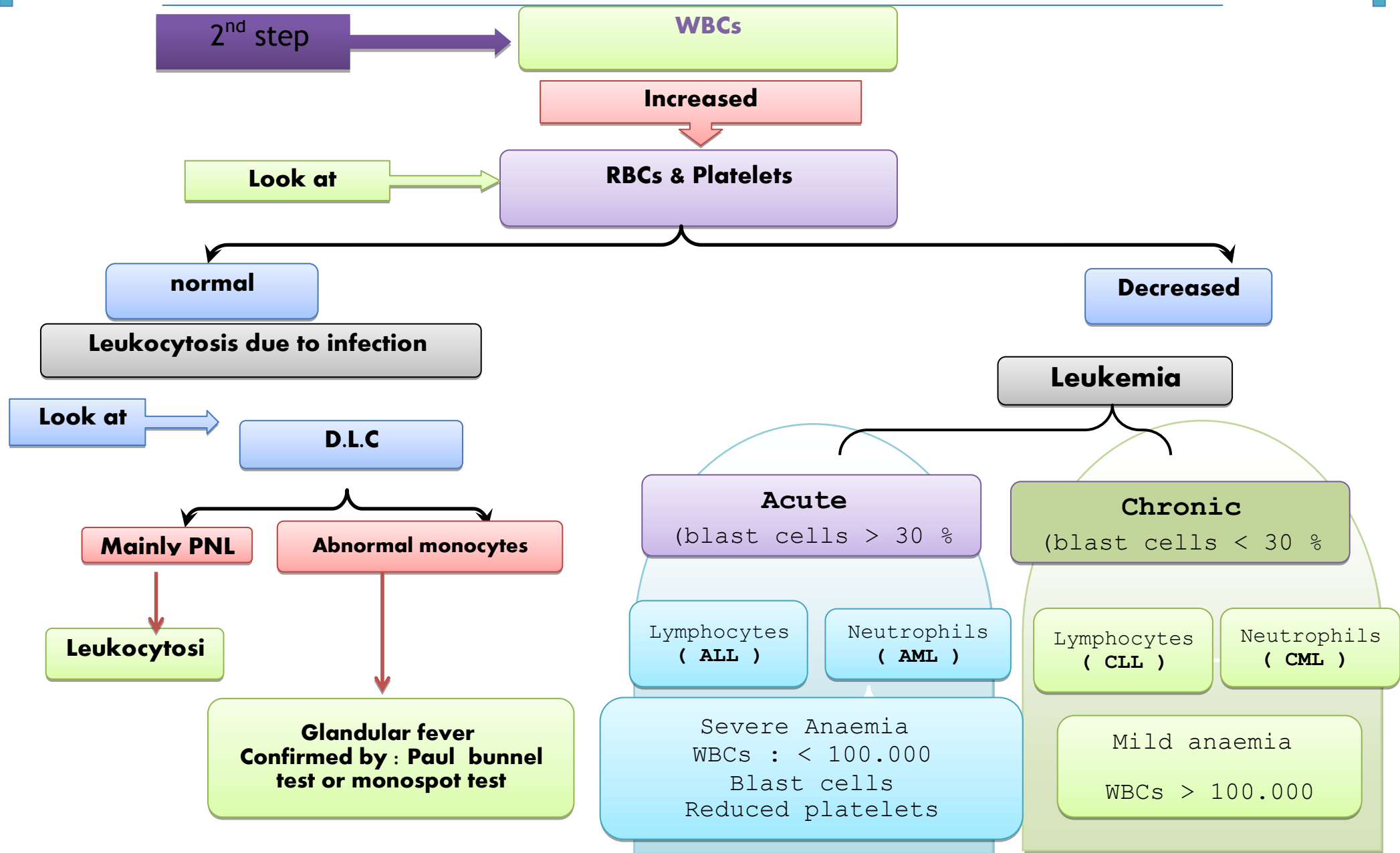
- Acute bleeding
- Haemolytic anaemia

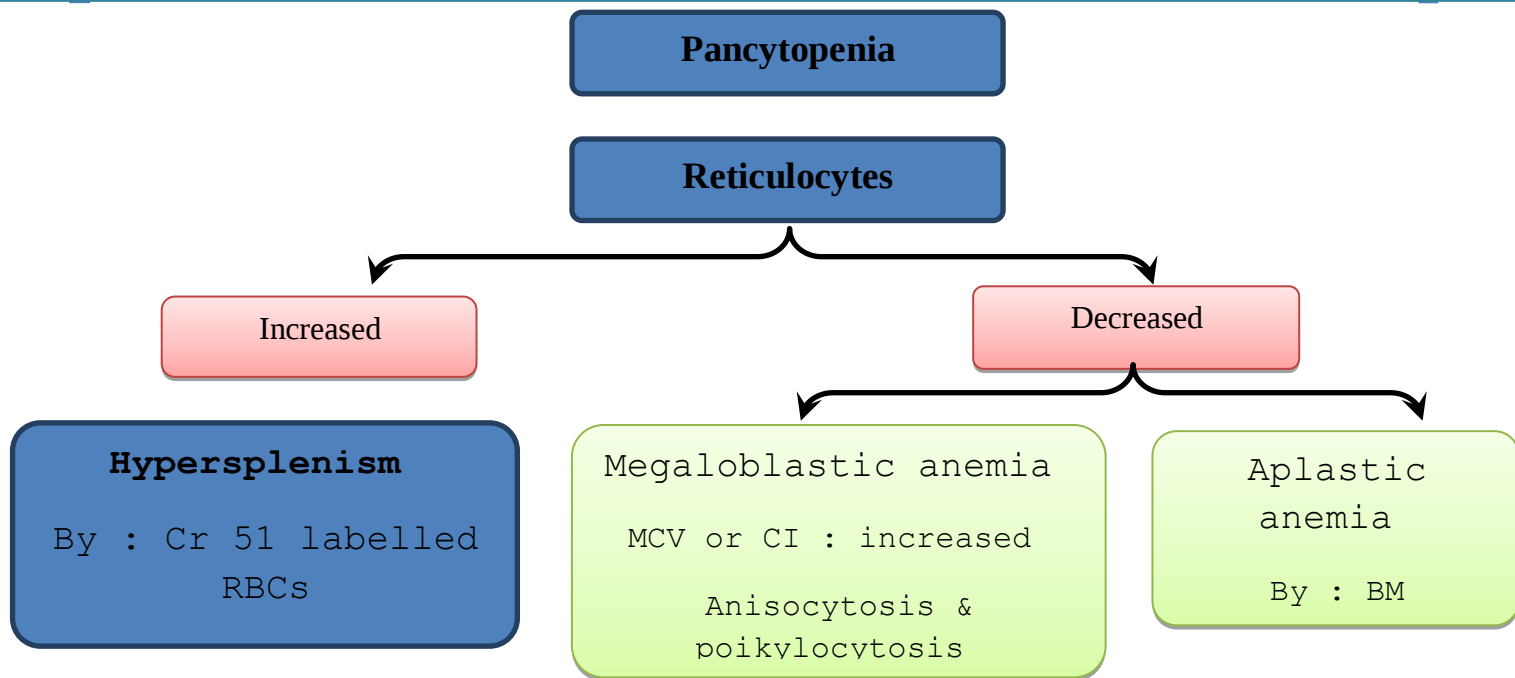
Microcytic hypochromic

Fe deficiency: Decreased Fe Level
 + Marked eosinophilia:- Ankylostoma
Chronic blood loss

Macrocytic

**Megaloblastic
anaemia**





- In any leukopenia there is a relative lymphocytosis (As, lymphocyte has an extramedullary origin).
- Shift to the left (staff\segment = increased) with leukocytosis
- Shift to the right (staff\segment = decreased) with megaloblastic
- Poly chromia :- reticulocytosis $\pm$ increased normoblast

BLOOD FILM:-

Shape:- biconcave

Abnormal shapes:-

Poikilocytosis :- Variable

Spherocytes:- hereditary spherocytosis – autoimmune haemolytic

Sickle:- sickle cell anaemia

Elliptical:- membrane defect

Stomatocytes:- membrane defect

Target:- thalassemia – LCF – O.J. – after splenectomy

Hinz bodies: pyruvate kinase deficiency

Papenhiemer bodies: sideroblastic

anisocytosis & poikilocytosis :-

in any deficiency anemia

Staff / segment cells

Normally: 1/5 – 1/10

Shift to left: Infection, anemia, leukemia.....

Shift to right.: Megaloblastic anemia

Report No. 1			Report No. 2		
1	Hb%	60 %	1	Hb%	55 %
2	RBCs	3.1×10^6	2	RBCs	2.1×10^6
3	○ MCV	80	3	● MCV	75
4	○ MCH	30	4	● MCH	25
5	○ MCHC	33	5	● MCHC	26
6	Platelets	30×10^3	6	Platelets	120×10^3
7	WBCs	240×10^3	7	WBCs	8×10^3
8	○ Neutrophil	95 %	8	● Neutrophil	66 %
9	● Eosinophils	0 %	9	Eosinophils	0 %
10	● Basophils	0 %	10	Basophils	1 %
11	● Monocytes	0 %	11	Monocytes	0 %
12	● Lymphocytes	5 %	12	Lymphocytes	33 %
13	Reticulocytes	---	13	Reticulocytes	2.4 %
14	Bleeding time	12 minute	14	Bleeding time	3 minutes
15	Coagulation time	5 minutes	15	Coagulation time	15 minutes
	Bast cells	4 %			

Report No. 3			Report No. 4		
1	Hb%	50 %	1	Hb%	50 %
2	RBCs	2.9	2	RBCs	2.5×10^6
3	○ MCV	77	3	● MCV	80
4	○ MCH	26	4	● MCH	30
5	○ MCHC	27	5	● MCHC	33
6	Platelets	25×10^3	6	Platelets	80×10^3
7	WBCs	7×10^3	7	WBCs	60×10^3
8	Staff \ segment	1 \ 4	8	Staff \ segment	1 \ 3
9	○ Neutrophil	70 %	9	● Neutrophil	95 %
10	● Eosinophils	1	10	Eosinophils	1 %
11	● Basophils	0	11	Basophils	0 %
12	● Monocytes	4	12	Monocytes	1 %
13	● Lymphocytes	25	13	Lymphocytes	3 %
14	Reticulocytes	10 %	14	Reticulocytes	0.4 %
15	Bleeding time	15	15	Bleeding time	9 minutes
16	Coagulation time	3	16	Coagulation time	3 minutes
			17	Blast cells	45 %

Report No. 5		
1	Hb%	60 %
2	RBCs	3.1×10^6
3	○ MCV	80
4	○ MCH	30
5	○ MCHC	33
6	Platelets	30×10^3
7	WBCs	180×10^3
8	○ Neutrophil	15 %
9	● Eosinophils	0 %
10	● Basophils	0 %
11	● Monocytes	0 %
12	● Lymphocytes	85 %
13	Reticulocytes	---
14	Bleeding time	11 minute
15	Coagulation time	5 minutes
	Blast cells	3%

Report No. 6		
1	Hb%	135 %
2	RBCs	8×10^6
3	● MCV	89
4	● MCH	30
5	● MCHC	33
6	Platelets	600×10^3
7	WBCs	20×10^3
8	● Neutrophil	66 %
9	Eosinophils	0 %
10	Basophils	1 %
11	Monocytes	0 %
12	Lymphocytes	33 %
13	Reticulocytes	----
14	Bleeding time	5 minutes
15	Coagulation time	5 minutes

Report No. 7			Report No. 8		
1	Hb%	60 %	1	Hb%	95 %
2	RBCs	3.1×10^6	2	RBCs	5×10^6
3	○ MCV	80	3	● MCV	89
4	○ MCH	30	4	● MCH	30
5	○ MCHC	33	5	● MCHC	33
6	Platelets	40×10^3	6	Platelets	300×10^3
7	WBCs	2.4×10^3	7	WBCs	20×10^3
8	○ Neutrophil	56 %	8	● Neutrophil	30 %
9	● Eosinophils	0 %	9	● Eosinophils	0 %
10	● Basophils	1 %	10	● Basophils	1 %
11	● Monocytes	0 %	11	● Monocytes	18 %
12	● Lymphocytes	43 %	12	● Lymphocytes	61 %
13	Reticulocytes	0 %	13	Reticulocytes	----
14	Bleeding time	11 minute	14	Bleeding time	5 minutes
15	Coagulation time	5 minutes	15	Coagulation time	5 minutes
	Blast cells	3%			

Answer of CBC reports:-

1	C.M.L.	2	Haemophilia + Fe def. Anaemia
3	Purpura + Fe def. Anaemia	4	A.M.L.
5	C.L.L.	6	Polycythemia (1ry)
7	Pancytopenis	8	Glandular fever

Urine analysis

<u>Physical</u>	<u>Chemical</u>	<u>Microscopic</u>
<u>Volume</u> : 800 – 1500	<u>Glucose</u> : Nill _	<u>RBCs</u> : 0 – 5 / HPF _
<u>Specific gravity</u> : 1015 – 1025	<u>Protein</u> : Nill _	<u>WBCs</u> : 0 – 5 / HPF
<u>Colour & aspect</u> : clear yellow	<u>Bile salts</u> : Nill	<u>Crystals</u> : Nill
<u>PH</u> : 4.5 – 7.4	<u>Bile pigments</u> : A) Billirubin : Nill B) urobilinogin : Nill	<u>Casts</u> : Nill or hyaline _

METHODS OF URINE COLLECTION

1. Random collection
2. Early morning collection
3. Clean-catch, midstream urine specimen collected after cleansing the external urethral meatus (***ideal***).
4. Catheterization of the bladder through the urethra
5. Suprapubic transabdominal needle aspiration of the bladder.

Appearance and Color

Clear to dark yellow due to urochrome.

- **Dark urine**:- the first specimen of the morning – Fever - hepatobiliary diseases
- **Red**:- gross hemorrhage - dietary (beets) - Rifampicin - GN
- **Turbid**:- pyelonephritis

Urine pH 5-7

- High acidity with Ca. oxalate & uric acid but alkaline with phosphates
- Urin may react alkaline by standing

Glucose

- The renal threshold of glucose is approximately 180 mg/dl.

Q: Causes of Glucosuria?

Specific Gravity

The ability of the kidney to concentrate urine.

Increase specific gravity are:

A) Increased excretion of metabolites:- DM and Addison's disease

B) Decreased plasma blood flow:- HF

C) loss of body water:- dehydration, diarrhea and vomiting.

Decreased specific gravity:- Renal failure and diabetes insipidus

NB. Specific gravity will normally vary with the amount of fluid intake and the time of day at which the specimen was collected.

Protein (accurately by amount of protein in 24 hrs urine)

- **Tamm-Horsfall protein:-** A small amount of filtered plasma proteins and protein secreted by the nephron can be found in normal urine not usually exceed 150 mg/24 hours
- **Micro-albuminuria** = 150 – 300 mg/24hrs.
- **Nephritic range of proteinuria** = 300 mg – 3.5 gm/hrs.
- **Nephrotic syndrome** = > 3.5 gm/24 hrs.

In some Lab. Proteinuria marked as number of + or mg%

- 2+ for 3+ proteinuria : correlates with most of renal disease
- 4+ proteinuria is characteristic of nephrotic syndrome.
- (proteinuria = more than 3.5 mg%)

Q: causes of Proteinuria?

Casts:- microscopic cylindrical bodies due to denaturation, coagulation and solidification of protein in the distal convoluted tubule (DCT) or the collecting duct (distal nephron) .

- Hyaline casts a mucoprotein (Tamm-Horsfall protein) secreted by tubule cells normally present.
- Red blood cell casts:- indicative of glomerulonephritis
- White blood cell casts:- Acute pyelonephritis
- Granular and waxy casts:- derive from renal tubular cell casts as in RF.
- Epithelial cast:- ATN
- Lipoid cast:- nephrotic S
- Broad casts:- from damaged and dilated tubules in end-stage chronic renal disease CRF.
- Telescoped urinary sediment:- red cells, white cells, oval fat bodies, and all types of casts 1) Lupus nephritis 2) malignant hypertension 3) diabetic glomerulosclerosis 4) rapidly progressive glomerulonephritis.

Crystals

Common crystals seen even in healthy patients include:-

- ***Calcium oxalate, triple phosphate crystals and amorphous phosphates.***
- Cystine crystals neonates with congenital cystinuria or severe liver disease
- Tyrosine crystals with congenital tyrosinosis or marked liver impairment
- Leucine crystals in patients with severe liver disease

Ketones

- Acetone, and beta-hydroxybutyric acid, are found in the urine when the body is metabolizing large amounts of fatty acids (inadequate carbohydrate utilization) as seen in **diabetes, fasting, alcoholic and starvation**

Bacteria (by culture):-

- A colony count more than 100,000/ml of one organism reflects significant bacteriuria.
- Multiple organisms reflect contamination.
- However, the presence of any organism in catheterized or suprapubic tap specimens should be considered significant bacteriuria.

1st step

Volume (800 - 1500)

A) Oliguria

B) Polyuria

Specific gravity

2nd step

Specific gravity

High specific gravity**Fixed 1010**

A) Functional (dehydration)
Normal RBCs .
B) Glomerulonephritis :
RBCs & smoky urine

ARF

High specific gravity
High glucose : DM

Low specific gravity
D . I

Fixed 1010
CRF

Proteinuria in
Diabetic nephropathy

Water deprivation test

On top of
GN : RBCs casts
PN : Pus cells

C) Normal volume

Look at Protein

>3.5 gm / day or 4 + : Nephrotic syndrome confirmed by lipid cast

Aspect

Turbid

Acute Pyelonephritis

Red

Hematuria for DD : stones – crystals - B

Brown & dark

Obstructive jaundice (bile salts present)

In some reports urine volume may not mentioned

So, diagnosis depends on **Sp. Gravity:-**

- 1- **Low sp. Gravity:-** D.I. or Functional.
- 2- **High sp. Gravity:-** Functional - D.M. (glucose) - PN (Pus) - GN (RBCs)
- 3- **Normal sp. Gravity:-** Protein (Nephrotic S.) – turbidity (PN) – Red (haematuria)
- 4- **1010 sp. Gravity:-** Renal failure (Pus:- PN -- RBCs:- GN)

<u>Report No 1</u>			<u>Report No 2</u>		
1	Volume	1200 cc\day	1	Volume	2500
2	Aspect	Clear	2	Aspect	Clear
3	Sp. G.	1018	3	Sp. G.	1140
4	Sugar	Nil.	4	Sugar	++++
5	Albumin	Nil.	5	Albumin	+
6	RBCs	0-1 HPF	6	RBCs	0-1 HPF
7	Pus cells	4 HPF	7	Pus cells	4 HPF
8	Casts	Hyaline	8	Casts	Hyaline
9	Others	Nil	9	Others	Nil
10	Reaction	Acidic	10	Reaction	Acidic

<u>Report No 3</u>			<u>Report No 4</u>		
1	Volume	2300 cc\day	1	Volume	500
2	Aspect	Watery	2	Aspect	Smoky
3	Sp. G.	1010	3	Sp. G.	1032
4	Sugar	Nil.	4	Sugar	+
5	Albumin	+	5	Albumin	+
6	RBCs	Nil.	6	RBCs	20 HPF
7	Pus cells	1 \ HPF	7	Pus cells	2 HPF
8	Casts	Hy. & granular	8	Casts	Red
9	Others	Nil	9	Others	Nil
10	Reaction	-	10	Reaction	

<u>Report No 5</u>			<u>Report No 6</u>		
1	Volume	1000 cc\day	1	Volume	1500
2	Aspect	Turbid	2	Aspect	Brown
3	Sp. G.	1024	3	Sp. G.	1017
4	Sugar	+	4	Sugar	+
5	Albumin	+	5	Albumin	+
6	RBCs	Nil.	6	RBCs	2 \ HPF
7	Pus cells	50 \ HPF	7	Pus cells	2 \ HPF
8	Casts	Hy. & WBCs	8	Casts	Hyaline
9	Others	Nil	9	Others	Bile salts
10	Reaction	-	10	Reaction	-

<u>Report No 7</u>			<u>Report No 8</u>		
1	Volume	2500 cc\day	1	Volume	500
2	Aspect	Watery	2	Aspect	Clear
3	Sp. G.	1040	3	Sp. G.	1095
4	Sugar	++++	4	Sugar	Nil.
5	Albumin	+++	5	Albumin	Nil.
6	RBCs	Nil.	6	RBCs	1 \ HPF
7	Pus cells	1 \ HPF	7	Pus cells	5 \ HPF
8	Casts	Lipoid & granular	8	Casts	Hyalin
9	Others	Nil	9	Others	Nil.
10	Reaction	-	10	Reaction	-

<u>Report No 9</u>			<u>Report No 10</u>		
1	Volume	600 cc\day	1	Volume	3500
2	Aspect	Smoky	2	Aspect	Watery
3	Sp. G.	1010	3	Sp. G.	1010
4	Sugar	Nil.	4	Sugar	Nil.
5	Albumin	Nil.	5	Albumin	+
6	RBCs	30 \ HPF	6	RBCs	2 \ HPF
7	Pus cells	1 \ HPF	7	Pus cells	40 \ HPF
8	Casts	Hyaline, granular, RBCs	8	Casts	Hyaline, granular, WBCs
9	Others	Nil	9	Others	Nil
10	Reaction	-	10	Reaction	

<u>Report No 11</u>			<u>Report No 12</u>		
1	Volume	4500 cc\day	1	Volume	1100
2	Aspect	Clear	2	Aspect	Reddish
3	Sp. G.	1004	3	Sp. G.	1020
4	Sugar	+	4	Sugar	+
5	Albumin	+	5	Albumin	+
6	RBCs	Nil.	6	RBCs	140 \ HPF
7	Pus cells	3 \ HPF	7	Pus cells	2 \ HPF
8	Casts	Hy.	8	Casts	Hyaline
9	Others	Nil	9	Others	-
10	Reaction	-	10	Reaction	-

Report No. 13	
<u>Physical</u>	
Volume	200cc (random sample)
Sp. Gravity	1025
Colour	Amber yellow
Aspect	Turbid
PH	Acidic
<u>Chemical</u>	
Glucose	Nil.
Protein	++
Bile salt	Nil.
Bile pig.	
a) bilirubin	Nil
b) urobilinogen	Trace
<u>Microscopic</u>	
Epithelial cells	++
RBCs	3 HPF
WBCs	100 HPF
Crystale	Nil.
Casts	Hyaline

Report No. 14	
<u>Physical</u>	
Volume	4000 cc \ 24hrs
Sp. Gravity	1002
Colour	Pale yellow
Aspect	Clear
PH	Acidic
<u>Chemical</u>	
Glucose	Nil.
Protein	Nil.
Bile salt	Nil.
Bile pig.	
a) bilirubin	Nil
b) urobilinogen	Trace
<u>Microscopic</u>	
Epithelial cells	Nil.
RBCs	3 \ HPF
WBCs	2 \ HPF
Crystale	Nil.
Casts	Hyaline

Report No. 15	
<u>Physical</u>	
Volume	200cc (random sample)
Sp. Gravity	1018
Colour	Brown
Aspect	Clead
PH	Acidic
<u>Chemical</u>	
Glucose	Nil.
Protein	Nil.
Bile salt	+++
Bile pig.	
a) bilirubin	++
b) urobilinogen	Nil.
<u>Microscopic</u>	
Epithelial cells	Nil.
RBCs	3 \ HPF
WBCs	2 \ HPF
Crystale	Nil.
Casts	Hyaline

Report No. 16	
<u>Physical</u>	
Volume	1600 cc \ 24hrs
Sp. Gravity	1020
Colour	Yellow
Aspect	Clear
PH	Acidic
<u>Chemical</u>	
Glucose	Nil.
Protein	++++
Bile salt	Nil.
Bile pig.	
a) bilirubin	Nil
b) urobilinogen	Trace
<u>Microscopic</u>	
Epithelial cells	Nil.
RBCs	3 \ HPF
WBCs	2 \ HPF
Crystale	Nil.
Casts	Hyaline & lipoid

Answer of urinalysis reports

1	Normal urine	2	DM
3	CRF	4	Niphrtic S.
5	Pyelonephritis	6	Jaundice
7	Kimmlestiel welson S.	8	Normal concentrated urine
9	ARF (on top of Gn.)	10	CRF (on top of Pn.)
11	DI	12	Haematuria
13	Acute pyelonephritis	14	DI
15	Obs. Jaundice	16	Nephrotic S.

Kidney function tests

Serum urea:- 20 – 40 mg %

Serum creatinine:- < 1mg %

Uric acid :- 2 – 7 mg %

How to reach diagnosis:-

Serum urea & creatinine elevated in **impairment of kidney function**

If associated with:-

High cholesterol + decreased albumin ===== **Nephrotic syndrome**

Electrolytes:-

Sodium	135 - 145 mEq/L
Potassium	3.5 - 5.2 mEq/L
Chloride	98 – 106 mEq/L
Calcium	8.4 - 10.5 mg/dL
Phosphate	2.5 - 5.0 mg/dL
Bicarbonate	22 - 29 mEq/L
BUN	7 - 18 mg/dL

Report No.1			
1	Serum urea	250 mg %	(20 – 40 mg %)
2	Serum creatinine	10.5 mg%	(0.2 – 1.2mg %)
3	Uric acid	9 mg%	(2 – 7 mg %)
4	Sodium	128 mEq/L	(135 - 145 mEq/L)
5	Potassium	6 mEq/L	(3.5 - 5.2 mEq/L)
6	Chloride		(98 – 106 mEq/L)
7	Calcium	7.1 mg %	(8.4 - 10.5 mg/dL)
8	Phosphate	8 mg %	(2.5 - 5.0 mg/dL)
9	Bicarbonate		(22 - 29 mEq/L)
10	BUN		(7 – 18 mg/dL)
	S glucose	200 mg %	

<i>Report No.2</i>			
1	Serum urea	140 mg %	(20 – 40 mg %)
2	Serum creatinine	3.1 mg%	(0.2 – 1.2mg %)
3	Uric acid		(2 – 7 mg %)
4	Sodium	139 mEq/L	(135 - 145 mEq/L)
5	Potassium	5.8 mEq/L	(3.5 - 5.2 mEq/L)
6	Cholesterol	350 mg %	(50 – 250 mg %)
7	Total protein	6 gm %	(6.5 – 8.5 gm %)
8	Albumin	2.3 gm %	(3.5 – 5.5 gm %)

<i>Report No.3</i>			
1	Serum urea	50 mg %	(20 – 40 mg %)
2	Serum creatinine	1.2 mg%	(0.2 – 1.2mg %)
3	Sodium	139 mEq/L	(135 - 145 mEq/L)
4	Potassium	5.0 mEq/L	(3.5 - 5.2 mEq/L)
5	Cholesterol	230 mg %	(50 – 250 mg %)
6	Total protein	6 gm %	(6.5 – 8.5 gm %)
7	Albumin	4.3 gm %	(3.5 – 5.5 gm %)

Answer of the training reports:-

No. 1	CRF
No. 2	CRF on top of nephrotic syndrome
No. 3	Normal

CSF

NORMAL RESULTS :

Physical	Composition
Colour : colourless	Cl : 720 – 750 mg / dl
Aspect : Clear	Glucose : 40 – 80 mg / dl
Pressure : 80 – 120 mmH ₂ O	Protein : 20 - 40 mg / dl
	Cells : 0 – 5 / HPF

No organism could be detected

Detection of aetiology of meningitis:

1. Septic (Bacterial):- ↓ glucose with ↑ PML
2. T.B.:- ↓ CL with ↑ lymphocytes
3. Viral :- Normal glucose & CL. With ↑ lymphocytes

Report No. (1)		
1	Colour	Turbid
2	Glucose	5 mg\100 ml (45-80mg\dl)
3	Cl	115 mmol\l (115-130 mmol\l)
4	Protein	150 mg\100ml (15-45 mg\dl)
5	Cells	300 (PNL)

Report No. (2)		
1	Colour	Clear
2	Glucose	60 mg\100ml (45-80mg\dl)
3	Cl	125 mg\100ml (115-130 mmol\l)
4	Protein	40 mg\100ml (15-45 mg\dl)
5	Colloid gold	
6	Cells	90 (lymphocytic)

Answer of training reports

1	Septic meningitis	2	Viral meningitis
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Stool analysis

Normal values:-

- 1- Colour:- Brown
- 2- Odour:- Fecal but not offensive
- 3- Reaction:- Alkaline

4- Content:-

Mucus:- Nil. (RBCs ++ & Mucus ++ = **Amoebic dysentery**)

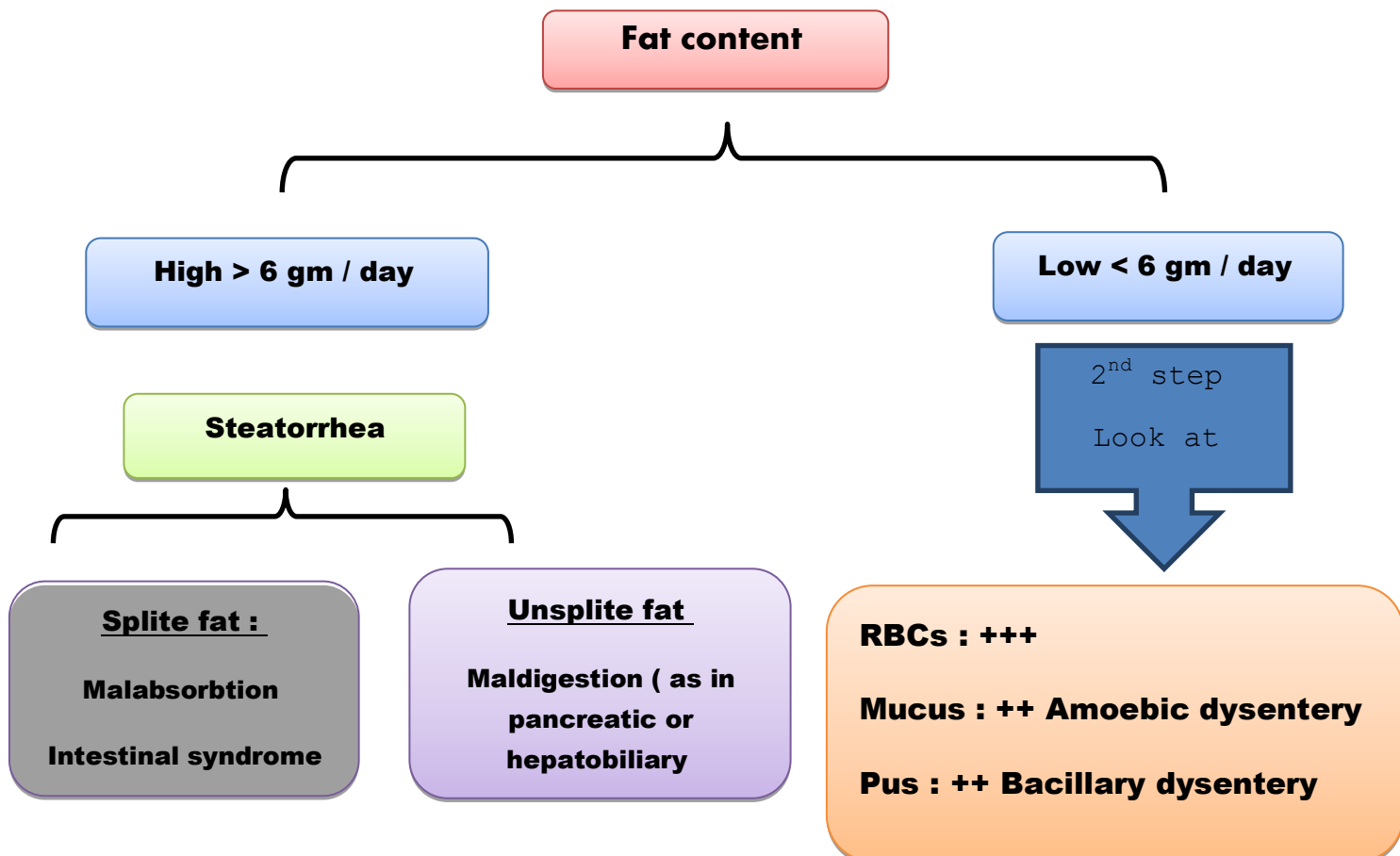
RBCs:- Nil. (RBCs ++ = **invasive inflammation** in amoebic or bacillary dysentery)

Pus cell:- Nil. (RBCs ++ & Pus cells ++ = **Bacillary dysentery**)

- 5- Fat :- less than 6 gm\ day (or less than 25%)

- Excessive unsplited fat (> 50 % of fat content) :- indicates **Maldigestion**

How to read this report:-



<u>Report No. 1</u>			<u>Report No. 2</u>		
1	Amount	Excessive	1	Amount	Excessive
2	Odour	Offensive	2	Odour	Offensive
3	Colour	Brown	3	Colour	Brown
4	Consistency	Loose	4	Consistency	Loose
5	Reaction	Alkaline	5	Reaction	Alkaline
6	Mucus	+	6	Mucus	+
7	Pus	+	7	Pus	+
8	RBCs	+	8	RBCs	+
9	Food residue	+++	9	Food residue	+++
10	Fat	Excessive	10	Fat	Excessive
11	Split	90 %	11	Split	10 %
12	Unsplit	10 %	12	Unsplit	90 %

<u>Report No. 3</u>			<u>Report No. 4</u>		
1	Amount	-----	1	Amount	Excessive
2	Odour	Offensive	2	Odour	Offensive
3	Colour	Brown	3	Colour	Brown
4	Consistency	Loose	4	Consistency	Loose
5	Reaction	Acidic	5	Reaction	Alkaline
6	Mucus	+++++	6	Mucus	+
7	Pus	+	7	Pus	+
8	RBCs	+++++	8	RBCs	+
9	Food residue	+	9	Food residue	+++
10	Fat	-----	10	Fat	Excessive
11	Split	-----	11	Split	50 %
12	Unsplit	-----	12	Unsplit	50 %

<u>Report No. 5</u>			<u>Report No. 6</u>		
1	Amount	-----	1	Amount	-----
2	Odour	Offensive	2	Odour	Offensive
3	Colour	Pale	3	Colour	Brown
4	Consistency	Watery	4	Consistency	Loose
5	Reaction	Alkaline	5	Reaction	Acidic
6	Mucus	+	6	Mucus	++++
7	Pus	++++	7	Pus	+
8	RBCs	+++++	8	RBCs	++++
9	Food residue	+	9	Food residue	+
10	Fat	-----	10	Fat	-----
11	Split	-----	11	Split	-----
12	Unsplit	-----	12	Unsplit	-----

Answer of training reports

1	Malabsorption	2	Maldigestion
3	Amoebic dysentery	4	Maldigestion
5	Bacillary dysentery	6	Amoebic dysentery

Liver function tests

I Syntheric function	II . Excretory function	III . Liver damage (enzymes)	IV . Metabolic function	V . others
1. Plasma proteins 2. Prothrombin	• Total bilirubin • Direct bilirubin Indirect bilirubin	• ALT • AST • Alkaline phosphates • GGT • 5 nucleotidase	• Cholesterol level • Glucose tolerance test	Alpho feto prt

I. Synthetic function

1. Plasma proteins:

- Total protein: 6-8 gm/dl
- Albumin: 3.5-5.5 gm/dl
- Globulin: 1.7-2.7 gm/dl
- AIG ratio: 2/1
-

Albumin is synthesized by liver only, and it has a long half life so affected in chronic liver disease and AIG ratio may be reduced (1/2)

2. Prothrombin: P.T. = 12-14 sec.

Only synthesized by liver depending on vit.k & has a short half life so affected in acute or chronic liver disease

I.N.R = international normalization ratio

= patient prothrombin T./ normal prothrombin = 0.8-1.2

- Used in monitoring patient on oral anticoagulant

II. Excretory

- Total Bilirubin < 1mg/dl (↑ in all types of jaundice)
- Direct Bilirubin < 0.2 mg/dl (↑ in obstructive jaundice)
- Indirect Bilirubin < 0.8 mg/dl (↑ in hemolytic)

N.B.: Both are elevated in hepato cellular jaundice

III. Liver damage

1. SGOT (AST)	2. SGPT (ALT)
- 7-40 Iu/l - Mitochondrial - Not specific - Short half life (early recovery)	- 7-40 Iu/l - Cytoplasmic - Specific - Long half life

↑ In alcoholism → AST/ALT > 2/1

- Markedly elevated in acute hepatitis or necrosis (shooting up > 10 folds)
- Around 3-4 folds in chronic liver diseases
- Normal or subnormal in advanced liver diseases

3. Alkaline phosphates (ALP)

Origin

Endothelium of bile duct & cell wall of hepatocytes
3-13 KAU (king Armstrong unit)

Markedly elevated in:

- Biliary obstructive (O.J.)
- Space occupying lesions
- Bone diseases

Not specific so specification by GGT is important.

4. Gamma Glutamyl trans peptidase (GGT)

Elevated in liver diseases, not in bone diseases

5. 5 Nucleotidase: specific

IV. Metabolism

Fat:

- S. cholesterol = 150-200 mg %
- In O.J. → hyper cholesterolemia
- In L.C.F. → normal cholesterol & decreased estrification

CHO:

- In cute liver diseases → hypoglycemia
- In chronic liver diseases → Impaired GTT

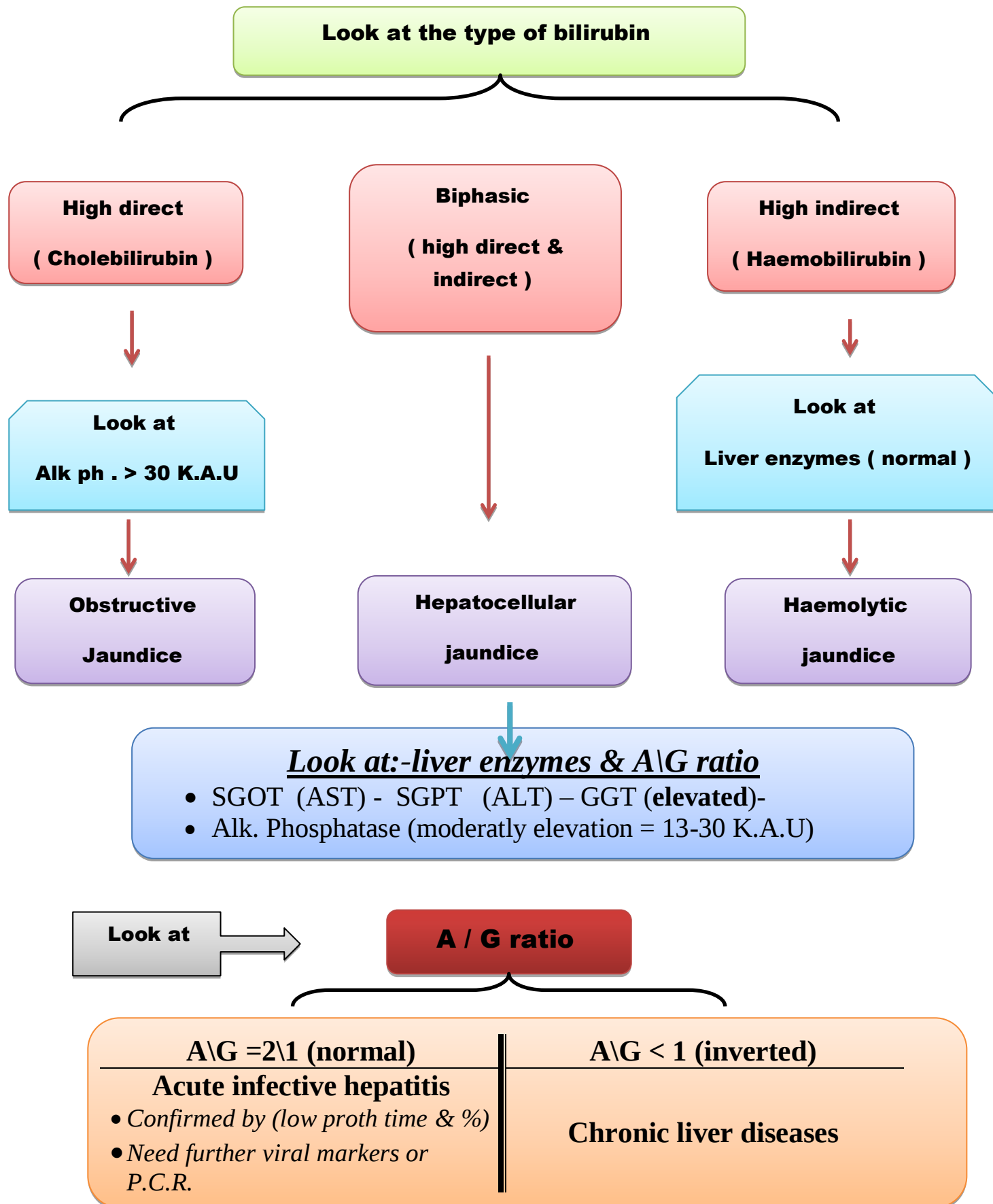
V. Others

As:

- Hepatitis markers
- Alpha feto protein

1st step

Bilirubin > 1 mg %



Report No. 1

1	Protein	5 gm/dL
2	Albumin	2.4 gm/dL
3	Globuline	----
4	A\G	1\2
5	Proth. Time	----
6	Proth. %	70 %
7	Total bilirubin	4.5 mg/dL
8	Dir. Bilirubin	3 mg/dL
9	Ind. Bilirubin	----
10	SGOT (AST)	90 U/L
11	SGPT (ALT)	100 U/L
12	Alk. Phosphatase	25 K.A.U

Report No. 2

1	Protein	7.0 gm/dL
2	Albumin	4.5 gm/dL
3	Globuline	----
4	A\G	2 \ 1
5	Proth. time	
6	Proth. %	
7	Total bilirubin	3.5 mg/dL
8	Dir. Bilirubin	2 mg/dL
9	Ind. Bilirubin	----
10	SGOT (AST)	240 U/L
11	SGPT (ALT)	180 U/L
12	Alk. Phosphatase	24 K.A.U

Report No. 3

1	Protein	6.7 gm/dL
2	Albumin	4.4 gm/dL
3	Globuline	----
4	A\G	----
5	Proth. Time	----
6	Proth. %	70 %
7	Total bilirubin	6 mg/dL
8	Dir. Bilirubin	5.5 mg/dL
9	Ind. Bilirubin	----
10	SGOT (AST)	28 U/L
11	SGPT (ALT)	22 U/L
12	Alk. Phosphatase	40 K.A.U

Report No. 4

1	Protein	7.0 gm/dL
2	Albumin	4.5 gm/dL
3	Globuline	----
4	A\G	2 \ 1
5	Proth. time	-----
6	Proth. %	100 %
7	Total bilirubin	3 mg/dL
8	Dir. Bilirubin	0.5 mg/dL
9	Ind. Bilirubin	----
10	SGOT (AST)	24 U/L
11	SGPT (ALT)	18 U/L
12	Alk. Phosphatase	11 K.A.U

Report No. 5			
1	Protein	7 gm/dL	(N. 6.6 - 8.6) gm/dL
2	Albumin	3.8 gm/dL	(N. 3.5 – 5.5) gm/dL
3	Total bilirubin	3.2 mg/dL	(N. 0.1 – 1.0) mg/dL
4	Dir. Bilirubin	1.2 mg/dL	(N. 0.0 – 0.25) mg/dL
5	SGOT (AST)	1250 U/L	(N. 0 – 32) U\L
6	SGPT (ALT)	1550 U/L	(N. 0 – 31) U\L
7	Alk. Phosphatase	390 U \L	(N. 79 – 240) U\L

Report No. 6			
1	Protein	7.4 gm/dL	(N. 6.6 - 8.6) gm/dL
2	Albumin	2.9 gm/dL	(N. 3.5 – 5.5) gm/dL
3	A\G	0.6	(N. 1.1 – 2.5)
4	Total bilirubin	0.88 mg/dL	(N. 0.1 – 1.0) mg/dL
5	Dir. Bilirubin	0.35 mg/dL	(N. 0.0 – 0.25) mg/dL
6	SGOT (AST)	95 U/L	(N. 0 – 32) U\L
7	SGPT (ALT)	80 U/L	(N. 0 – 31) U\L
	Alk. Phosphatase	287 U\L	(N. 79 – 240) U\L

Answer of training reports

1	Chronic infective hepatitis	2	Acute infective hepatitis
3	Obs. Jaundice	4	Haemolytic jaundice
5	Acute infective hepatitis	6	Chronic infective hepatitis

Viral markers of HBV

HBs Ag	Infection by HBV . >6 months = carrier state	Last 3 – 6 months .
HBs Ab	Old infection by HBV . Immunization (Vaccine)	
HBc Ag	Not detected	Need liver biopsy .
HBc Ab	Ig M : recent infection . Ig G : old infection	Both + ve in reinfection
HBe Ag	Highly infectious .	Called precore : Measure the viral reproductivity
HBe Ab	Less infectious	

Viral markers of HCV:-

HCV \ Ab :- HCV infection (should confirmed by PCR)

Report No. 1		Report No. 2	
HBs Ag.	-ve	HBs Ag.	+ ve
HBs Ab.	+ ve	HBs Ab.	- Ve
HBc Ab. (Ig G)	+ ve	HBc Ab. (Ig G)	- Ve
HBc Ab. (Ig M)	- ve	HBc Ab. (Ig M)	+ ve
HBe Ag.	-ve	HBe Ag.	+ ve
HBe Ab.	-ve	HBe Ab.	- ve

Report No. 3		Report No. 4	
HBs Ag.	+ ve (> 6 months)	HBs Ag.	-ve
HBs Ab.	- ve	HBs Ab.	+ ve
HBc Ab. (Ig G)	- ve	HBc Ab. (Ig G)	- ve
HBc Ab. (Ig M)	- ve	HBc Ab. (Ig M)	- ve
HBe Ag.	-ve	HBe Ag.	-ve
HBe Ab.	-ve	HBe Ab.	-ve

Report No. 5		Report No. 6	
HBs Ag.	- ve	HBs Ag.	-ve
HBs Ab.	- ve	HBs Ab.	+ ve
HBc Ab. (Ig G)	+ ve	HBc Ab. (Ig G)	- ve
HBc Ab. (Ig M)	+ ve	HBc Ab. (Ig M)	- ve
HBe Ag.	-ve	Hbe Ag.	-ve
HBe Ab.	-ve	Hbe Ab.	-ve
		HCV\ Ab	+ Ve

Full reports of LFTs + Viral markers :-

Report No. 7			
1	Protein	5.5 gm/dL	(N. 6.6 - 8.6) gm/dL
2	Albumin	2.3 gm/dL	(N. 3.5 – 5.5) gm/dL
3	Total bilirubin	3.2 mg/dL	(N. 0.1 – 1.0) mg/dL
4	Dir. Bilirubin	1.2 mg/dL	(N. 0.0 – 0.25) mg/dL
5	SGOT (AST)	80 U/L	(N. 0 – 32) U\L
6	SGPT (ALT)	77 U/L	(N. 0 – 31) U\L
7	Alk. Phosphatase	390 U \L	(N. 79 – 240) U\L
8	HBs Ag.	-ve	
9	HBs Ab.	+ ve	
10	HBc Ab. (Ig G)	+ ve	
11	HBc Ab. (Ig M)	- ve	
12	HBe Ag.	-ve	
13	HBe Ab.	-ve	

Answer of training reports

1	Old HBV infection	2	Highly infectious acute Pt.
3	HBV carrier	4	HBV vaccination
5	HBV reinfection	6	HCV
7	Chronic liver disease on top of old HBV infevtion		

Glucose tolerance test

Indications:

- For diagnosis of Diabetes Mellitus (DM)
- To differentiate between patients with DM and Impaired Glucose Tolerance (IGT)

Patient preparation:

- Allow at least three days of unrestricted diet (carbohydrate intake > 200 g/day) prior to testing.
- If the patient is febrile or acutely ill, the test should be postponed until clinical improvement.
- Allow at least six weeks after myocardial infarction or major surgery before testing.

Procedure:

1. Fast the patient overnight 6-10 hours (water allowed).
2. Patient should rest for at least 30 mins prior to testing.
3. No food, drink or cigarette smoking is allowed until the test is completed.
4. Take blood and urine samples for "fasting" glucose level
5. The patient is given 75 g of glucose followed by a further 100 mls water, consumed over a 5 min period.
6. Serial samples are taken every 30 minutes after the glucose load
7. Between samples, the patient should ideally remain seated.

Normal value

WHO criteria for **Venous Plasma** measurements. For non pregnant individuals these are:

Sample	Normal	Diagnostic
Fasting	80 – 120 mg %	> 126 mg %
1 st hr Post Prandial	< 180 mg %	
2 nd hr Post Prandial	< 140 mg % (return to fasting)	> 200 mg %
1- glucose in urine=== -Ve in all samples		

Diagnosis of D.M.

1. **F.B.G.** ≥ 126 mg/dl
2. **2nd hr p.p. B.G** ≥ 200 mg/dl
3. **2nd hr P.P. B.G** = 140 – 200 mg/dl
= Impaired G.T.T.

Glucosuria without D.M $\rightarrow$ look at 1st hr P.P. B.G

$\underbrace{\hspace{10em}}$
 $\underline{> 180 \text{ mg/dl}}$ $\underline{< 180 \text{ mg/dl}}$
Alimentary glucosuria **Renal glucosuria**

Keton in urine:-

- 1- in starvation & alcoholism
- 2- in severe DM

Report No. 1			Report No. 2		
1	Urine gluc.	+ ve in all samples	1	Urine gluc.	+ ve in 1 st sample
2	Fasting	300 mg %	2	Fasting	175 mg %
3	1 st hour	350 mg %	3	1 st hour	195 mg %
4	2 nd hour	220 mg %	4	2 nd hour	160 mg %

Report No. 3			Report No. 4		
1	Urine gluc.	- ve in all samples	1	Urine gluc.	+ ve
2	Fasting	90 mg %	2	Fasting	-----
3	1 st hour	160 mg %	3	1 st hour	150 mg %
4	2 nd hour	160 mg %	4	2 nd hour	100 mg %

Report No. 5		
1	Urine gluc.	- ve in all samples
2	Fasting	90 mg %
3	1 st hour	170 mg %
4	2 nd hour	110 mg %

Answer of the training reports:-

No.1	DM	No.2	DM
No.3	Impaired G.T.T	No.4	Renal glucosuria
No.5	Normal G.T.T.		

Serological tests

SEROLOGICAL TESTS IN RHEUMATIC DISEASES

In Systemic Lupus Erythematosus

LE Cell

Antinuclear Antibody Test. (ANA)

Anti-Double Stranded DNA.

Anti-Smith Antibody.

Anti-Ribonucleoprotein Antibody.

Anti-ribosomal P Antibody.

In Rheumatoid Arthritis

Rheumatoid Factor.

In others

***Sjögren's Antibodies:* Anti-Ro/SSA and anti-La/SSB.**

Anti-Histone Antibodies in *Drug-Induced Lupus.*

Anti-Phospholipid Antibodies

Scleroderma Antibodies

A.N.A. (antinuclear antibody)	+ Ve in SLE
Coomb's	Immune haemolytic anaemia
Weil-felix	Typhus
ASOT	> 250 todd's in children > 500 todd's in adults (For recent strept. Infection)
Brucella agglutination	+Ve in brucellosis from the 2nd week titer > 1\160 diagnostic (rising titer)
C-reactive protein	Graded as 1+ - 4+ (in any tissue damage)
Rose-waaler – bentonite – latex	For rheumatoid factor (in Rheumatoid arthritis)
Paul-bunel	Monospot test for diagnosis of IMN

ESR & CBC:- May be helpful

Acute phase reactant:- high ESR, leucocytosis & C-reactive protein

ESR :- (1st hr ; 0 – 15 ===== 2nd hr < 30)

Widal test:- agglutination test for diagnosis of typhoid and para typhoid

Rising titer is more important than single high titer

Types of antibodies

<O> Abs. (non specific)	<H> Abs. (specific)
Indicates recent infection (1\40 – 1\80)	Anti H typhoid (1\40 – 1\80)
	Anti H para A (1\80 – 1\100)
	Anti H para B (1\80 – 1\100)

The 3 anti H increased :-

- Vaccination
- Anamnestic reaction

Report No. 1			Report No. 2		
1	Anti O	1\40	1	Anti O	1\40
2	Anti H	1\190	2	Anti H	1\50
3	Anti H para A	1\90	3	Anti H para A	1\90
4	Anti H para B	1\100	4	Anti H para B	1\250

Report No. 3			Report No. 4		
1	Anti O	1\145	1	Anti O	1\40
2	Anti H	1\45	2	Anti H	1\160
3	Anti H para A	1\245	3	Anti H para A	1\250
4	Anti H para B	1\90	4	Anti H para B	1\270

Report No. 5			Report No. 6		
1	Anti O	1\120	1	Anti O	1\40
2	Anti H	1\160	2	Anti H	1\40
3	Anti H para A	1\100	3	Anti H para A	1\95
4	Anti H para B	1\100	4	Anti H para B	1\270

Report No. 7		
1	Anti O	1\220
2	Anti H	1\60
3	Anti H para A	1\358
4	Anti H para B	1\92

Report No. 8

ESR	1 st hr:-	54
	2 nd hr:-	82
Rheumatoid factors	Latex	+ Ve
	Ros waaler	64 DAT (< 16)
ASOT	125	(< 166 todd units)

Report No. 9

ESR	1 st hr:-	54
	2 nd hr:-	82
Rheumatoid factors	Latex	- Ve
	Ros waaler	- Ve (< 16)
ASOT	800	(< 166 todd units)

Answer of the training reports

1	Old typhoid	2	Old paratyphoid B
3	Recent para A	4	Vaccination
5	Recent typhoid	6	Old para B
7	Recent para A	8	Rheumatoid arthritis
9	Rheumatic fever		

Thyroid function tests

Normal values:-

T₃	1.3 – 5.0 pg/dL
T₄	0.8 - 2.0 pg/dL
TSH	0.3 - 5.0 IU/mL

Level of T3 & T4

Decreased in myxedema		Increased in thyrotoxicosis
Look at TSH		Decrease in TSH
Decreased Pituitary myxedema	Increased Thyroid myxedema	Thyrotoxicosis

<u>Report No. 1</u>			<u>Report No. 2</u>		
T₃	0.4 pg%	(N.1.3 -5.0)	T₃	0.3 pg%	(N.1.3 -5.0)
T₄	0.1 ng%	(N. 0.8 – 2.0)	T₄	0.1 ng%	(N. 0.8 – 2.0)
TSH	< 0.01 IU \ml	(N.0.3 – 5.0)	TSH	> 75 IU \ml	(N.0.3 – 5.0)

<u>Report No. 3</u>		
T₃	6.7 pg%	(N.1.3 -5.0)
T₄	4.9 ng%	(N. 0.8 – 2.0)
TSH	< 0.01 IU \ml	(N.0.3 – 5.0)

Answer of the training reports

1	Pituitary myxedema
2	Thyroid myxedema
3	Thyrotoxicosis

CARDIAC ENZYMES (CARDIAC LAB.)

1- Creatine Kinase = Creatine Phosphokinase (CK):-

Normal value

Male:- 25 - 90 U/L

Female:- 10 - 70 U/L

Creatine Kinase is muscle enzyme found in the heart, brain and muscles.

Increased CK-MB is seen with heart muscle damage.

CK-MB CK isoenzyme:- It begins to increase 6 - 10 hours after an acute MI, peaks in 24 hours, and remains elevated for up to 72 hours.

Creatine Kinase-MB 0 - 5 U/L

CK elevation:-

- Strenuous exercise
- weight lifting
- surgical procedures
- high doses of aspirin
- cholesterol-lowering drugs.

2- Lactate dehydrogenase (LDH) -

Total LDH will begin to rise 2 - 5 days after an MI
Can last 10 days.

Normal value :- LDH 45 - 90 U/L

LDH elevation:-

- Liver and kidney disease
- Pernicious and megaloblastic anemias
- Malignancy
- Progressive muscular dystrophy
- Pulmonary emboli.

LDH-1 and LDH-2 LDH isoenzymes -

Flipped pattern (LDH 1 > LDH 2) appears 12-24 hours post MI and persists for 48 hours.

3- Serum glutamic oxaloacetic transaminase (SGOT) = aspartate aminotransferase (AST)

Begin to rise in 8-12 hours and peak in 18-30 hours.

SGOT= 7 - 40 U/L

SGOT elevation:-

- Liver disease (accompanied with ALT elevation)
- Cholesterol-lowering

4- Myoglobin:- (Not specific)

- Early and sensitive diagnosis of MI

- Raised within 1 - 2 hours - peaks in 4-8 hours - drop in about 12 hours.

Myoglobin, serum (male): 30 - 90 µg/ml

Myoglobin, serum (female): 30 - 90 µg/ml

5- Troponin

- Peaks in 10-24 hours, begins to fall off after 1-2 weeks.

Troponin T and I, are specific to myocardium T and I, are specific to myocardium

Troponin T and I: < 0.0 - 0.10 µg/mL.